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Field of the Invention

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Related Background Art

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In addition, a small telephone has a small battery in order to reduce the weight of the telephone. If a

large sound is reproduced or an echo canceler is driven
for the hands-free talking, a large current flows and
the battery is consumed greatly. A speech time or a
standby time may be shortened. Such a telephone is not
5 therefore suitable for indoor use.

SUMMARY OF THE INVENTION

It is an object of the invention to provide
communications of good quality by using communication
10 apparatus capable of communication via different
communication lines.

It is another object of the present invention to
provide an easy-to-use communication system having a
first communication apparatus capable of communication
15 via a first communication line and a second
communication apparatus capable of communication via a
second communication line.

It is another object of the present invention to
make a communication apparatus capable of communication
20 by itself be usable as a communication adapter for
another communication apparatus.

Other objects and features of the present
invention will become apparent from the following
detailed description of embodiments when read in
25 conjunction with the accompanying drawings.

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BRIEF DESCRIPTION OF THE DRAWINGS

5 Figs. 1A and 1B are schematic diagrams showing the structures of a wireless telephone apparatus and a facsimile apparatus according to an embodiment of the invention.

Fig. 2 is a block diagram showing the structure of the wireless telephone apparatus 103 shown in Fig. 1.

Fig. 3 is a block diagram showing the structure of the facsimile apparatus 101 shown in Fig. 1.

10 Fig. 4 is a flow chart illustrating the operation of a hands-free talking process.

Figs. 5A and 5B are memory maps of a ROM 208 and a ROM 302 as storage media.

15 DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

In the following, the description will be given for the embodiments of the invention including a wireless telephone apparatus, a communication apparatus, a wireless talking method, and a storage medium. In the embodiments, the wireless telephone apparatus is applied to a PHS (Personal Handy-phone System) telephone in Japan and the communication apparatus is applied to a facsimile apparatus.

25 Figs. 1A and 1B are schematic diagrams showing the structures of a wireless telephone apparatus and a facsimile apparatus according to the embodiment of the invention. The facsimile apparatus 101 has a

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connection unit 102 for the connection to the wireless telephone apparatus 103. This connection unit 102 may be built in the facsimile apparatus 101 or detachably mounted on the facsimile apparatus 101. The facsimile apparatus 101 is connectable to a radio channel (wireless line) via the wireless telephone apparatus 103 or to a wire channel such as a PSTN channel and an ISDN channel. The wireless telephone apparatus 103 has a connection unit (corresponding to a connector 213 shown in Fig. 2).

Fig. 1A shows the state that the wireless telephone apparatus 103 is not connected to the facsimile apparatus 101. This state corresponds to the state that the wireless telephone apparatus 103 is connected to a radio channel 104 and can have a telephone conversation over the radio channel 104. In this case, a speaker 105 and a microphone 106 built in the wireless telephone apparatus 103 are used for the telephone conversation.

Fig. 1B shows the state that the wireless telephone apparatus 103 is connected to the facsimile apparatus 101. This state corresponds to that the wireless telephone apparatus 103 functions as a wireless adapter and that the facsimile apparatus is connected to a radio channel 104 via the wireless telephone apparatus 103 and can have a telephone conversation. In this case, a speaker 107 and a

In this embodiment, the radio system is PHS.

Fig. 2 is a block diagram showing the structure of the wireless telephone apparatus 103. The wireless telephone apparatus 103 has a microphone 106, a speaker 105, an ADPCM codec 203, a channel codec 204, a wireless communication unit 205, key switches (operation keys) 210, a display unit 211, a CPU 207, a ROM 208, a RAM 209, a communication apparatus I/F unit 212, a connector 213, and a battery BAT 214.

20 The microphone 106 receives sounds and outputs a
sound signal. The ADPCM codec 203 converts a sound
signal input from the microphone 106 into an ADPCM code
to transmit it over the radio channel, and converts a
received ADPCM code into an analog voice signal to
25 output it from the speaker 105. The channel codec 204
converts voice data and control data into data in
conformity with a PHS communication system, and derives

The radio communication unit 205 has the antenna 206 and various electronic components, the antenna 206 being used for the connection to the radio channel 104 of a base station provided by a radio common carrier.

CPU 207 controls the whole of the wireless telephone apparatus (a child apparatus). ROM 208 stores programs and parameters to be used for controlling the whole of the wireless telephone apparatus, the programs being executed by CPU 207. RAM 209 temporarily stores parameters to be used for controlling the whole of the wireless telephone apparatus, and transmission/reception data. The battery (BAT) 214 is connected to the facsimile apparatus or communication apparatus to charge the battery, and used as the power source of the wireless telephone apparatus 103.

The communication apparatus I/F unit 212 has a circuit for detecting whether the wireless telephone apparatus 103 is connected to the facsimile apparatus 101 and a control circuit for switching an output of an audio signal to the facsimile apparatus 101. The

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image data and data files to be transmitted and received, data of a character code format, and the like.

The operation panel 304 is used for a user to
5 instruct each operation of the facsimile apparatus 101
and is used for displaying the state of the facsimile
apparatus 101. The reader unit 305 reads a facsimile
transmission original or a copy original as a color
image or a black/white image. The recorder unit 306
10 prints out a facsimile reception original or a copy
original in color or black/white.

The communication control unit 307 performs a control and transmission/reception of a facsimile communication protocol such as G3 and G4, a control of signal modulation/demodulation, a control of a line echo canceler and an acoustic echo canceler for hands-free talking, an off-hook control and an on-hook detection for a public telephone apparatus line 308 such as PSTN and ISDN, and the like. In this embodiment, the communication control unit 307 also has a function of switching analog upstream and downstream signals transferred via the connection unit 102 between the microphone 108 and speaker 107 of the facsimile apparatus, and supplying a signal transferred via the public telephone apparatus line 308 to the handset 311 during a normal talking mode or switching the signal between the microphone 108 and speaker 107 of the

The connection unit 102 has a wireless telephone apparatus I/F unit 309 and a connector 310. The wireless telephone apparatus I/F unit 309 is used for the interface with the wireless telephone apparatus 103 and has an audio signal connection circuit for receiving an audio signal from the wireless telephone apparatus 103, a power supply circuit for charging the battery BAT of the wireless telephone apparatus 103, and a circuit for detecting a connection of the wireless telephone apparatus 103. The connector 310 is physically (electrically) connected to the connector 213 of the wireless telephone apparatus 103. Signal lines connected via the connector 310 include upstream and downstream audio signal lines and power source lines for charging the battery of the wireless telephone apparatus 103.

Input/output lines of the wireless telephone apparatus I/F unit 309 are connected by the communication control unit 307 to the line echo canceler and acoustic echo canceler for the hands-free talking mode, in order to receive radio waves of audio signals transmitted from the wireless telephone apparatus 103.

Next, the connection units of the wireless telephone apparatus 103 and facsimile apparatus 101 will be described. The connector 213 connected to the

communication apparatus I/F unit 212 of the wireless
telephone apparatus 103 and the connector 310 connected
to the wireless telephone apparatus I/F unit 309 of the
facsimile apparatus 101 can be removably connected
5 together. The signal lines connected via these
connectors 213 and 310 include, as described earlier,
the upstream and downstream audio signal lines used for
talking via the radio channel 104, power source lines
for charging the battery BAT 214 of the wireless
10 telephone apparatus 103, and a signal line used for a
detection signal notifying that the wireless telephone
apparatus 103 is detected to the facsimile apparatus
101.

Digital signals such as a command signal, a
15 response signal and a status signal are exchanged in
some cases between the wireless telephone apparatus 103
and facsimile apparatus 101. Such digital signals may
be exchanged by a general I/F unit such as a serial I/F
unit.

20 Whether there is an electrical connection between
the wireless telephone apparatus 103 and facsimile
apparatus 101 can be confirmed: by detecting a current
flowing through the connectors 213 and 310; or in
addition to a detection of the current flowing through
25 the connectors, by a presence/absence of a signal
through the digital I/F unit or by a presence/absence
of an audio signal during the hands-free talking mode.

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This electrical connection may also be confirmed, on the side of the wireless telephone apparatus 103 by a presence/absence of a charge voltage between the power source lines from the facsimile apparatus 101, and on the side of the facsimile apparatus 101 by a detection of the charge current with electronic components including a photocoupler. The electrical connection may also be confirmed by on/off of mechanical switches provided to both the wireless telephone apparatus 103 and facsimile apparatus 101.

Next, the operations of the wireless telephone apparatus 103 and facsimile apparatus 101 constructed as above will be described. Fig. 4 is a flow chart illustrating the hands-free talking process. A program realizing each step shown in this flow chart is stored in ROM 208 of the wireless telephone apparatus 103 and ROM 302 of the facsimile apparatus 101 and executed by CPU 207 and CPU 301.

When a connection operation of the wireless telephone (PS) 103 to a radio channel is executed, it is checked whether the radio channel is established (whether PS is captured) (Step S401). When the radio channel is established, the wireless telephone apparatus enters a talking state in which a usual talking is performed via the radio channel 104 by the wireless telephone apparatus 103 itself (Step S402). If the connection operation by the wireless telephone

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Next, talking paths of the facsimile apparatus (BS) 101 are switched (Step S405). A signal from the connector 310 is input to the communication control unit 307 via the wireless telephone apparatus I/F unit 309. An audio input/output signal is switched to the line echo canceler side to cancel a line echo. An audio input/output signal to and from the speaker 107 and microphone 108 of the facsimile apparatus 101 is switched to the acoustic echo canceler side. The connection to the two echo cancelers may be switched upon generation of an echo.

After the talking paths of the wireless telephone apparatus 103 and facsimile apparatus 101 are switched at Steps S404 and S405, hands-free (HF) talking becomes possible at the facsimile apparatus 101 via the radio channel 104.

The wireless telephone apparatus 103 operates by using a power supplied from the facsimile apparatus 101 without using its battery 214 (Step S406). The communication apparatus I/F unit 212 switches between the battery (BAT) 214 and the power source of the facsimile apparatus 101, to thereby supply a power from the facsimile apparatus 101 to the wireless telephone apparatus 103 via the connectors 310 and 213. If the power source voltage of the facsimile apparatus 101 is higher than that of the battery 214 of the wireless

telephone apparatus 103, the power is supplied from the facsimile apparatus 101 to the wireless telephone apparatus 103.

Thereafter, the wireless telephone apparatus 103
5 again checks the connection between the wireless
telephone apparatus (PS) 103 and facsimile apparatus
(BS) 101 (Step S407). If the connection is maintained,
it is checked whether a disconnection of the radio
channel is confirmed (Step S408). If not, the
0 operations at Steps S406, S407 and S408 are repeated.

If the wireless telephone apparatus 103 judges at Step S408 that the radio channel was released or disconnected, an operation is executed to make the talking paths of the wireless telephone apparatus 103 take default paths (Step S409). Specifically, in order to transmit an audio signal from the microphone 106 via the radio channel, the input path to the ADPCM codec 203 is switched from the contact 215b to the contact 215a by the switch 215, and in order to output audio data of an ADPCM code received via the radio channel to the speaker 105, the switch 216 changes its contact from the contact 216b to the contact 216a. In this manner, the microphone 106 and speaker 105 are connected to the ADPCM codec 203.

25 Upon detection of a change of the talking paths of
the wireless telephone apparatus 103 to the default
paths, the wireless telephone apparatus 101 executes an

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If the wireless telephone apparatus 103 is connected to the facsimile apparatus 101 although the

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operation of changing its talking paths to the default paths (Step S413). Specifically, as described previously, a connection of a signal from the connector 310 to the communication control unit 307 via the wireless telephone apparatus I/F unit 309 is released. The default paths for talking with the handset 311 via the public telephone line 308 are set for the usual talking operation.

For the hands-free talking via the public telephone line 308, an audio input/output signal to and from the communication control unit 307 via the public telephone line 308 is connected to the line echo canceler side, and an audio input/output signal to and from the speaker 107 and microphone 108 of the facsimile apparatus 101 is connected to the acoustic echo canceler, to thereby switch the talking paths. The connection to the two echo cancelers may be switched upon generation of an echo. With the above operations, the hands-free talking becomes possible.

The wireless telephone apparatus 103 can enter thereafter the usual talking state and can continue talking via the radio channel 104 by itself (Step S414). The facsimile apparatus 101 resumes the standby state.

As described above, the portable wireless telephone apparatus 103 of this embodiment has the talking function for wireless talking via the radio

channel 104, and operates as the wireless adapter of the facsimile apparatus 101 when connected to the facsimile apparatus 101 or communication apparatus.

While the facsimile apparatus 101 is connected to
5 the wireless telephone apparatus 103 and executes
wireless talking via the radio channel 104, the
wireless telephone apparatus 103 is used as the
wireless adapter for wireless talking via the radio
channel. Therefore, the hands-free talking becomes
10 possible by using the microphone 108 and speaker 107
for input/output audio signals supplied via the radio
channel.

If the wireless telephone apparatus 103 is connected to the facsimile apparatus 101 during talking, the hands-free talking becomes possible by using the microphone 108 and speaker 107 of the facsimile apparatus 101 and the echo cancelers. It is possible to automatically detect that the wireless telephone apparatus 103 is connected to the facsimile apparatus 101. It is also possible to supply a power from the wireless telephone apparatus 103 to the facsimile apparatus 101.

In this embodiment, although the facsimile apparatus having the hands-free talking function has been described, other apparatus may also be used if they have the hands-free talking function. For example, a hands-free talking apparatus may be realized

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in the flow chart of Fig. 4.

The program modules are stored in corresponding ones of ROM 208 of the wireless telephone apparatus 103 and ROM 302 of the facsimile apparatus 101, and
5 executed by corresponding ones of CPU 207 and CPU 301. Instead, the program modules may be stored only in ROM 208 of the wireless telephone apparatus 103. In this case, when the wireless telephone apparatus 103 is connected to the facsimile apparatus 101, CPU 207 of
10 the wireless telephone apparatus 103 transfers the program module to the CPU 301 of the facsimile apparatus 101 when necessary.

The storage medium storing the program module is not limited only to ROM, but other storage media may be
15 used such as a floppy disk, a hard disk, an optical disk, a magnetooptical disk, a CD-ROM, a CD-R, a DVD, a magnetic tape, and a nonvolatile memory card.

As described so far, according to the present invention, the wireless telephone apparatus can be made
20 compact and can facilitate outdoor use. In an indoor circumstance, hands-free talking of a good quality can be realized by using a communication apparatus such as a facsimile. A wireless telephone apparatus easier to use can be realized matching a use circumstance.

25 The wireless telephone apparatus has the talking function when it is connected at an indoor or outdoor to a public telephone line or a dedicated radio

channel, and operates when it is connected to a
communication apparatus. The communication apparatus
performs wireless talking such as hands-free talking
via a radio channel when it is connected to the
5 wireless telephone apparatus. During the hands-free
talking, a power consumption of the wireless telephone
apparatus can be suppressed.

Communication via a base station is possible
without degrading the merits of a wireless telephone
10 apparatus. If the wireless telephone apparatus is
connected to a communication apparatus such as a
facsimile apparatus, then a talking means, a power
supply circuit and echo cancelers respectively built in
the facsimile apparatus can be used for communication.

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